

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Mitigation of Orbital Debris in the New Space)	IB Docket No. 18-313
Age)	

To: The Commission

COMMENTS OF LOCKHEED MARTIN CORPORATION

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Lockheed Martin Corporation (“Lockheed Martin”) provides these Comments in response to the Commission’s above-captioned notice of proposed rulemaking regarding the mitigation of orbital debris.¹ Lockheed Martin agrees with the Commission that the world is at the next turning point in the history of space development and in-orbit operations, and that it is time to revisit the Commission’s initial approach to orbital debris, a set of regulations adopted fifteen years ago.

The critical purpose for the Commission, the whole of the United States Government, and the world’s spacefaring community in addressing orbital debris is to ensure a safe space environment for innovation for today, tomorrow, and the future. The Commission’s approach in this proceeding must enable a comprehensive risk mitigation framework for the space environment – without unnecessarily constraining the innovations and opportunities that the productive and constructive uses of space portend.

¹ *Mitigation of Orbital Debris in the New Space Age*, Notice of Proposed Rulemaking in IB Docket No. 18-313, FCC 18-159 (rel. Nov. 19, 2018) (“*NPRM*”).

I. INTRODUCTION AND SUMMARY

Lockheed Martin's space engagement encompasses global communications and global positioning to deep space exploration, weather and remote sensing, military space, national security, and advanced technology development. Lockheed Martin manufactures satellite buses that form the core for nearly any space mission from nanosats to high-powered spacecraft. Lockheed Martin is a developer and manufacturer of advanced satellite systems and solutions operating in the United States and around the world, providing a variety of services that are deployed, or soon to be deployed, in all of the satellite frequency bands in use today. Lockheed Martin is also building NASA's Orion spacecraft, the only spacecraft designed for crewed long-duration, deep space exploration. Through these capabilities, Lockheed Martin has a longstanding and first-hand understanding of the complexity and risks inherent in space operations of any kind, and of the threat that unmitigated orbital debris poses to all that dwells in the space domain.

With humans on spacecraft in low Earth orbit ("LEO") as well as plans to transport humans to the moon and interplanetary destinations, the threat to humans from orbital debris is also real. As small satellites represent an evolving technology for launch of shorter-duration mission payloads, the proliferation of these objects will necessarily pose an added source of orbital debris going forward.

The generation of orbital debris from space operations is inevitable. The need, therefore, is to establish a sustainable space environment, through a concerted worldwide commitment to the utilization of effective best practices for minimizing the unnecessary creation of orbital debris and maximizing the extent to which debris that is created can be eradicated or relegated to areas where the dangers it poses to space operations and humankind are contained.

In its *NPRM*, the Commission recognizes two fundamental truths: First, that the effort to reduce orbital debris and minimize its effects is not a new effort, but instead is one that has long been practiced by most users of outer space. This is a significant point in that it inherently accepts that regulation of orbital debris cannot be a snapshot in time, but an iterative process, where lessons and experiences – both positive and negative – can be digested and applied on an ongoing basis.² Second, that the Commission’s role in the overall management of the mitigation of orbital debris is as one player on a team that includes other agencies of the United States Government with interests in the space domain, as well as the broader worldwide space community. It is only with a concerted effort – with the United States Government as a unified whole taking the lead in relevant fora such as the Inter-Agency Space Debris Coordination Committee (“IADC”) and the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Use of Outer Space (“UN COPUOS”) – that the long-term sustainability of the globally-shared space domain for U.S. space system operators and all others will be ensured.³ Both of these truths, in various ways, inform the comments – general and specific – that Lockheed Martin provides below in response to the *NPRM*.

II. DISCUSSION

A. General Points

Lockheed Martin asserts that the success of any orbital debris mitigation policies depends upon a whole-of-government approach in the United States, given the vested interests and critical roles of multiple Departments and Agencies in the space domain. Moreover, Lockheed Martin is

² See, e.g., *NPRM*, FCC 18-159, at ¶¶ 6-7, 10.

³ *Id.*, at ¶ 7.

equally cognizant that the space domain is a globally shared environment, thus international collaboration with other spacefaring nations and their stakeholders' "buy-in" to a U.S.-led approach is ultimately another critical element to success. Finally, Lockheed Martin also emphasizes the need to ensure that U.S. leadership in the international spacefaring community does not inadvertently create either incentives for regulatory forum-shopping or competitive disadvantages for U.S. system operators.

In the context of the whole-of-government approach, Lockheed Martin emphasizes the importance of ensuring a fully-coordinated interagency framework, with each agency bringing its expertise, experience, and requirements into the process. It is also important that the international spacefaring community engage, including the U.S. and non-U.S. commercial space operators, in the development of orbital debris policies. The United States Government, including the Commission, is motivated to create a risk-management policy that is based on collaboration with all stakeholders in the space domain. The certainty afforded by such a policy will mitigate against an unintended result of placing U.S. commercial space industries, including those operating today as well as those designed for the future, at a collective disadvantage or, even worse, drive them offshore in order to compete.

While Lockheed Martin believes the space community would have been better served procedurally by the launching of a Notice of Inquiry rather than an NPRM, Lockheed Martin urges the Commission to proceed with a focus on information gathering at this stage, rather than proceeding directly to regulation. Even as there is a need for some very basic regulatory-based requirements, the dramatic evolution in the uses of space today requires a more flexible, adaptive orbital debris mitigation approach – whether based on new operational experience gained, new capabilities developed, or an emerging international consensus. Ensuring the right global

approach to a safe and competitive space environment that adequately reflects the needs that foster innovation is paramount.

Lockheed Martin applauds the Commission for recognizing the importance of the orbital debris situation to entities that operate in the space domain and agrees that the advent of large constellations of non-geostationary orbit (“NGSO”) satellites warrants a broad review of the regulations adopted in 2004 and their suitability for the developing environment. At the same time, Lockheed Martin – mindful of the fact that the Commission acknowledges that it is but one player on the U.S. orbital debris mitigation team – urges a U.S. Government-led multi-stakeholder consultative and information gathering process as a first step, prior to moving to the promulgation of regulations. Lockheed Martin would expect that non-U.S. space stakeholders could participate in that multi-stakeholder process as well.

For example, the Commission correctly notes “the importance of a coordinated, effective regulatory environment that meets the dual goals of orbital debris mitigation and furthering U.S. space commerce,” and states its willingness to consider updates to U.S. orbital debris guidance if relevant documents or initiatives are updated while the instant proceeding is open.⁴ The Commission should avoid the creation of a static risk management approach for orbital debris; instead, it should consider the need for an iterative, flexible and adaptive method of addressing the operational experiences that will be gained, even if through just the FCC-authorized satellite operators.

Next, Lockheed Martin has some concerns about the number of proposed reporting and disclosure requirements. In many of these instances, the Commission seems to conclude that new or more burdensome disclosure obligations by commercial space applicants for FCC

⁴ *Id.*, at ¶ 14.

authorizations are warranted but provides little guidance on how the disclosed information would be used. In one example, the Commission proposes a requirement to identify any liquids that, if either intentionally or unintentionally released, will persist in a droplet form that could pose dangers to other space objects.⁵ The Commission does not, however, quantify or otherwise indicate how this information would be assessed, other than through a statement of how the risk of liquid release was minimized. This type of unfulfilled disclosure obligation creates regulatory uncertainty in terms of space system design and promotes the development of an experiential body of rulings/precedents on an *ad hoc* basis that may be detrimental to U.S. industry, if not similarly reflected by other spacefaring nations.

Lockheed Martin maintains that where there is uncertainty in the proposed disclosure requirement, those topics can be better addressed through guidance developed at both the U.S. and international (*e.g.*, IADC and UN COPUOS) levels, informed by the experience gained by various U.S. Government agencies and Commission licensees (and others) based on best practices observed. From there, checklists or specific subsystem guidance (or actual rules, where needed) can be provided that are both meaningful to the system developer and provide the proper amount of regulatory certainty. The Commission regulations can – subject perhaps to some confidentiality exceptions – require submission of the information it seeks and request confirmation of steps taken to minimize dangerous conditions, but it cannot, and should not, leave applicants and/or licensees in a position of providing information without understanding at the outset how that information is to be used to assess their orbital debris mitigation plans.⁶

⁵ *NPRM*, FCC 18-159, at ¶ 23.

⁶ In Lockheed Martin's view, collected information would permit the Commission to participate meaningfully in the development of best practices guidance in the relevant national and international fora.

Finally, Lockheed Martin has some concerns with the Commission's use of broad terms that may not have a clear definition or even a common usage. For example, the Commission uses the term "operational orbit" in several places in its *NPRM* and proposed rules. In some instances, it refers to the operational orbit as the orbit where spacecraft are intended to operate or formerly operated.⁷ In other places, it uses the altitude of the operational orbit as a determining factor for potential regulatory obligations.⁸ What is not clear is how the term would apply to future commercial space missions that are not Earth-centric (such as lunar missions or interplanetary and other deep-space missions), or that are in Earth orbit for just a short time before leaving for other mission objectives. The assessment of these space operations for compliance with orbital debris mitigation regulations, including post-mission disposal requirements, needs to be carefully considered.

Overall, Lockheed Martin understands and concurs with the initiative being launched through this proceeding. However, as indicated earlier, Lockheed Martin is of the view that the proposal of specific regulations (as opposed to the initiation of a meaningful, interagency and international discussion due to the changing space domain) may be premature. Some of the broader concerns about where specific items are addressed, as well as the concerns about specific disclosures and interpretation of specific items, could be resolved by having the Commission contribute to the updating of interagency and international orbital debris mitigation guidance and policies before attempting to convert its experiences and views into direct regulations.

⁷ See, e.g., *NPRM*, FCC 18-159, at ¶ 42.

⁸ *Id.*, at ¶ 31, and Proposed Rule §25.114(d)(14)(iv)(2).

B. Specific Comments

In this section of its Comments, Lockheed Martin offers some responses to specific inquiries and proposals the Commission makes in the *NPRM*.

1. Release of Liquids

The Commission observes that its current rules do not require the disclosure of liquids that do not present an explosion risk, but that could cause damage if released into space by virtue of their persistence in droplet form.⁹ The Commission proposes that applicants include in the orbital debris mitigation plan the measures taken to eliminate the risk of liquids release and/or reduce the amount of time (*e.g.*, through choice of orbit) that they will pose a danger in the space domain.

Lockheed Martin understands from the context in the *NPRM* that the discussion of persistent liquids refers principally to propellants. What is unclear is whether this discussion, and the attendant proposed new obligation, extends as well to ammonia vents and urine vents on Earth-bound trajectories, and how long a “very short orbital lifetime” is for released liquids. Lockheed Martin urges the Commission to clarify that commercial space missions that operate in a near rectilinear halo orbit (“NRHO”) and/or in the lunar environment – including the power and propulsion elements (“PPE”) thereof, lunar descent/ascent modes, and refueler modules – would be exempt from the proposed liquid droplet disclosure obligations. In none of these cases is there the type of persistent threat from liquid droplets that the Commission is proposing to change its rules to address.

⁹ *Id.*, at ¶ 23.

2. Orbital Selection and Variances

The Commission asks a number of questions regarding orbital selection with a view toward gathering additional information that would advance the goal of preventing collisions in congested orbits (particularly in the LEO region) and protecting space assets. These questions are far-ranging, and cover topics as diverse as protecting the International Space Station and post-mission disposal considerations.¹⁰

One question the Commission poses is whether it should adopt a maximum limit for variances in orbit for NGSO systems. Here, the Commission inquires whether limiting variances in altitude above or below the “operational orbit” specified in a NGSO system application would enable more systems to be authorized and safely operated, and would help avoid collisions and reduce orbital debris generation in critical orbits.¹¹

In Lockheed Martin’s view, the Commission has no present technical basis for adopting a rule limiting altitudinal variances for NGSO system satellites, and it would be especially important not to introduce a rule limiting variances in the context of orbital debris mitigation. The question of variances or tolerances when it comes to NGSO satellite orbital characteristics is one that is just now beginning to be examined in the International Telecommunication Union (“ITU”) Radiocommunication Sector. This is an extremely complicated issue that involves a multitude of interrelated considerations that will take much study to unpack. It is unlikely that there is a bright-line test for altitude variations that could meaningfully be identified today. In other words, it is unlikely that a satellite being operated at 100 km higher than its nominal orbit altitude of 1000 km would be found to materially change the interference environment, while a

¹⁰ *Id.*, at ¶¶ 30-35.

¹¹ *Id.*, at ¶ 35.

satellite at 99 km higher in altitude does not. Moreover, even if it could be stated for sake of argument that a 10 percent variance in nominal orbit altitudes was insignificant in terms of the risk of additional interference or requirement for additional protection, associated changes in other orbital parameters (*e.g.*, inclination) could have a combined effect that does significantly change the interference profile.

The point on variances is that this is primarily an interference-based matter that has not been studied yet. Imposing any limit on altitude variances before the operational impacts can be assessed is premature and could have unintended negative consequences in terms of constraints on innovations and competition in satellite system design and operation. In addition, the ambiguity of some of the terminology employed (*see* discussion of “operational orbits” in Section II.A above) is a further reason not to regulate altitudinal variances in this proceeding.

3. Satellite Tracking Data

The Commission posits that improvements over the years in the ability to track and identify satellites in NGSO orbits may help to reduce the risk of collisions – particularly if used for the increase in the number of small satellites. The Commission seeks information on the nature of satellite tracking (*i.e.*, active or passive), telemetry markers, and whether technologies associated with tracking/information sharing are sufficiently developed to be amenable to a regulatory requirement.¹²

In response, Lockheed Martin notes that the use of radio frequency emitters containing a unique signature is standard in all other domains where traffic must be managed, namely air and

¹² *Id.*, at ¶ 36. The Commission specifically asks whether it should adopt a rule requiring NGSO satellite operators to provide information regarding initial deployment, ephemeris, and planned maneuvers to the Air Force unit that is responsible for maintaining and managing the U.S. Strategic Command’s space situational awareness program. *Id.*, at ¶ 37.

maritime. Any space system will contain hardware necessary to transmit telemetry, thus the development and implementation of a unique telemetry signature or beacon would have minimal impact on spacecraft development.¹³ As orbital regimes continue to become more densely populated, the challenge of “cross tagging” or confusing one object with another will increase. Telemetry beacons with unique signatures provide a simple solution to mitigate this challenge by allowing a multi-phenomenology tracking solution that greatly reduces error.

With respect to the U.S. Strategic Command’s space situational awareness program and in the case of multi-satellite deployments, the existing resources will be stressed to discriminate and maintain custody of closely spaced objects during their deployment. During regular operations, station keeping maneuvers executed by NGSO satellite operators can lead to “lost” satellites, where automated catalog maintenance algorithms are unable to correlate disparate space tracks with the pre-maneuver orbital position of a particular satellite. Resolving these “lost” satellite positions involves orbital expert intervention and utilizes resources from the Air Force’s 18th Space Control Squadron (which manages the U.S. Strategic Command program) that could be applied to higher priority efforts.

Commercial satellite operators providing ephemeris information on a regular basis, as well as pre- and post-maneuver information could reduce the frequency and duration of manual intervention in the catalog maintenance process. This type of data sharing practice has already been established by leading satellite operators through the Space Data Association (“SDA”) and is facilitated by the Non-Traditional Data Pre-Processor (“NDPP”), which enables operators to securely share information with the Air Force’s 18th Space Control Squadron. Lockheed Martin supports this voluntary approach as a way forward, rather than a regulatory mandate. Where

¹³ While ground based radar and optical trackers provide highly accurate tracking information for objects in orbit, the limited capacity and sparse nature of these trackers dictate a limited revisit rate for any particular space object.

gaps may be identified, incentives should be explored to address those gaps.

Lockheed Martin emphasizes that the security of any ephemeris or other tracking data shared with the Air Force is a paramount consideration. If this data were to make it into the wrong hands, either intentionally or unintentionally, NGSO system operations would be vulnerable to direct attack or subversion. The Commission should not proceed with any requirement for operators to provide detailed tracking data outside the U.S. Government until data security can be assured on a going forward basis.

Finally, the Commission proposes that NGSO system applicants must certify that, upon receipt of a conjunction warning, they will take all possible steps to assess and mitigate collision risks, including sharing ephemeris data and operational information with the affected operator, and modifying spacecraft operations.¹⁴ Lockheed Martin believes that commercial operators should commit to taking affirmative steps to mitigate collision risks upon receipt of a conjunction warning, but there may be situations where it is impossible or inappropriate to share ephemeris data or operational information with another operator, or it may not be possible to meaningfully modify operations (*e.g.*, if there is no propulsion system on the spacecraft). Perhaps the obligation here should be to take all possible steps to assess the collision risk, and to take all practicable steps to mitigate that risk.

4. Post-Mission Disposal Matters

The Commission proposes to require applicants to provide information on the expected reliability of disposal measures involving atmospheric reentry, including the method by which

¹⁴ *NPRM*, FCC 18-159, at ¶ 38.

such reliability expectations were derived. The Commission also inquires whether a specific probability of success should be required (*e.g.*, 90 percent).¹⁵

Lockheed Martin observes that a casualty risk assessment is already required for reentry of objects. The Commission must avoid creating duplicative regulatory requirements and avoid adding burdensome requirements that do not advance the goal of reducing orbital debris in the long term. If the applicant's expectation is to dispose of space vehicles through atmospheric reentry, requiring a specific probability of success appears arbitrary and unnecessary.

Lockheed Martin does not concur with the Commission's proposal that applicants be required to certify that all NGSO satellites that will operate at an altitude of 650 kilometers or more will be initially deployed into orbit at an altitude below 650 km and not maneuvered to their planned operational altitude until the operator determines that the satellite has full functionality.¹⁶ Lockheed Martin does not see the rationale for this proposal yet can foresee potentially very restrictive, profoundly negative impacts on satellite system design and functionality. Even the term "full functionality" as described in the *NPRM* is quite open to interpretation.

The proposal would also seem to involve having newly-launched satellites – often in great numbers – linger at unadvertised altitudes for significant periods of time while functionality is ascertained and orbit-raising maneuvers can be initiated. This would decrease transparency regarding operations, reduce satellite lifetimes, and, above all, increase the risk of collision and the generation of orbital debris. In Lockheed Martin's view, a better way of

¹⁵ *Id.*, at ¶ 46.

¹⁶ *Id.*, at ¶ 48. The Commission describes full functionality as the situation where communications have been established with the spacecraft, major satellite systems are operational in accordance with the design, and the satellite is able to perform de-orbit maneuvers. *Id.*, at ¶ 48 n.117.

serving the same objective would be to require more ground testing to help ensure the usability of a satellite.

The Commission’s proposal that applicants for NGSO systems state that “spacecraft disposal” will be automatically initiated in the event of the loss of power or contact with the spacecraft¹⁷ is daunting to operators, and fraught with unanswered questions. Would there be a grace period to allow operators to recover tumbling or non-responsive spacecraft? How long would this period be? What is the obligation if the operator has an arrangement or seeks an arrangement with an operator in the emerging field of on-orbit satellite servicing?¹⁸ Initiating automatic maneuvers following a loss of power or other loss of contact is extremely risky and would likely have significant unintended consequences for the operator and for other operators. Lockheed Martin urges the Commission to engage in greater consultations in this area and recognize that it is not ripe today for a proposed rule. There simply are too many unasked and unanswered questions, and too few specifics, to form the basis of any regulation in this proceeding.

On the subject of the post-mission disposal of spacecraft in the 650-2,000 km altitude region of space – what the Commission refers to as the higher portion of low-Earth orbit – the Commission seeks comment on whether spacecraft disposal must either be by retrieval or by atmospheric reentry.¹⁹ Lockheed Martin maintains that post-mission disposal of satellites

¹⁷ *Id.*, at ¶¶ 49-50.

¹⁸ The Commission actually asks about the status of the development of the nascent direct spacecraft retrieval/servicing subsegment of the industry later in the *NPRM*. This subject is clearly linked to the proposal for automatic initiation of de-orbiting, and should be considered together. Lockheed Martin believes there is a tremendous future in this subsegment of the industry, and anticipates that satellite servicing will, in time, be of a significant benefit to the mitigation of orbital debris and protection of the space domain.

¹⁹ *NPRM*, FCC 18-159, at ¶¶ 52-53.

operating in higher low-Earth orbit should be determined by the applicant/operator on a case-by-case basis derived from baseline mission life requirements. There is no single solution or solution set available today (as evidenced by the options stated in the IADC guidelines the Commission cites), and direct retrieval options, while promising, are still an emerging technology with no track record of successful implementation. The nature of the issues of post-mission disposal of spacecraft from the higher low-Earth orbit range is understood today, and solutions will evolve. Applicants should be provided guidance as technology evolves, but subject today only to a “do not make things worse” type of general obligation and a duty to consider implementation of new methods as the state of the technological art advances over their systems’ mission lifetimes.

5. GSO License Term Extensions

Lockheed Martin is generally supportive of the Commission’s proposals regarding the consideration of applications seeking to extend the license terms of satellites in geostationary orbit beyond the initial 15-year license terms,²⁰ but does not feel that it is appropriate to limit extensions to five years if a longer term is justifiable based on a review of the provided specifics. Lockheed Martin believes that as part of the information submission, the Commission should accept information on satellite performance metrics that is relevant to the extension request. There may be cases where this type of information is more relevant to the extension inquiry than some or all of the specific points of information specified in Proposed Rule 25.121. Due to the continual improvements in the state of the satellite technological art, Lockheed Martin is not supportive of any codification of details on particular satellite buses that may warrant

²⁰ *NPRM*, FCC 18-159, at ¶¶ 65-66.

“heightened scrutiny” for the purpose of license extension requests, and does not view an obligation to immediately report specific types of anomalies affecting post-mission disposal as appropriate.²¹ A continuing obligation to take measures to maximize the probability of safe post-mission disposal is sufficient.

6. Operational Rules

Lockheed Martin supports the Commission’s inclusion of orbit-raising telemetry, tracking, and command (“TT&C”) functions in the authority for normal NGSO satellite systems.²² Lockheed Martin also supports the Commission’s tentative conclusion²³ that the public interest warrants coordination of end-of-life TT&C critical to NGSO spacecraft maneuvering and notes that this is effectively what would happen in most situations anyway. The Commission should, however, clarify that these obligations are not applicable to non-Earth-centric orbiting missions.

The Commission’s proposal²⁴ to require NGSO system operators to share ephemeris data with all operators of systems using the same region of space raises some concerns. Lockheed Martin, however, recognizes the need to provide this information to the U.S. governmental entity responsible for the civilian space object database and cataloging and to share it with other Commission satellite authorization holders for spectrum coordination purposes. As discussed above (*see* Section II.B.3), the Commission is proposing that, in the interests of avoiding in-orbit

²¹ *See id.*, at ¶ 67.

²² *Id.*, at ¶ 70.

²³ *Id.*, at ¶ 71.

²⁴ *Id.*, at ¶ 73.

collisions or conjunction events, the FCC-licensed operators share highly sensitive and proprietary data with entities that may not be the appropriate recipients of that information. Data security is a continuing, and significant concern. For these reasons, Lockheed Martin does not support mandatory requirements to share the information among satellite operators; it instead supports encouraging further the voluntary sharing of this information.

Nevertheless, Lockheed Martin recognizes that the sharing of ephemeris data and maneuver plans with the U.S. governmental entity responsibly for the space object database and cataloging (currently the Air Force’s 18th Space Control Squadron) will greatly reduce the frequency of “lost” satellites in situations where automated catalog maintenance algorithms are unable to correlate disparate space tracks with the pre-maneuver orbital position of a particular satellite. Competitive concerns regarding the sharing of ephemeris and maneuver information can be mitigated by instituting the independent U.S. governmental entity as the arbiter of information, sharing conjunction alerts as necessary based on current and planned ephemeris – but only if the security of the data can be assured.

Lockheed Martin is receptive to the Commission’s notion that encryption of TT&C links for satellites with propulsion capabilities is an important step in preventing malicious actors from seizing command of satellites and potentially using them to cause collisions,²⁵ and is generally supportive of the proposal to require encrypted TT&C links.²⁶ At this time, and to avoid unduly limiting university-sponsored and similar projects involving cubesats, the regulation should be limited to satellites with propulsion. The Commission needs to remain mindful that the concern

²⁵ *Id.*, at ¶ 75.

²⁶ National Institute of Standards and Technology (“NIST”) and Risk Management Framework (“RMF”) standards for encryption and management of encryption keys should be applied to mitigate this threat.

being addressed in this proceeding is the mitigation of orbital debris.

7. Liability and Indemnification Issues

On the subject of liability, the Commission recognizes that neither its review of an applicant's orbital debris mitigation plan nor its grant of an authorization alters in any way the liability of an applicant or licensee relating to the space operations.²⁷ This is an important recognition, and while Lockheed Martin offers some views below on the questions the Commission has posed, it maintains that the instant proceeding is not one where the policy questions regarding liability and indemnification should or can be addressed. These are separate matters that may be beyond the scope of the Commission's jurisdiction.

Under the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, the United States Government could be held responsible for launches/satellites launched from the United States. Launch providers typically carry insurance up to the point of satellite separation, and such coverage sometimes persists for up to an additional 30 days or until all launch vehicle components return to Earth. Not all satellite system operators carry on-orbit liability policies, and there are complexities here that may mitigate against the Commission's indemnification proposals.

This area is one where the Commission needs to tread carefully to ensure that actions it proposes do not undercut the U.S. satellite industry or negatively affect the competitiveness of U.S. industry players in the world arena. Imposing stringent indemnification obligations on U.S. applicants and licensees while other countries impose less stringent or no obligations could dissuade satellite applications from seeking U.S. authorizations, heighten forum shopping, and

²⁷ *Id.*, at ¶ 77.

ultimately undermine the United States' stated goal of maintaining leadership in space.

Lockheed Martin urges the Commission and other U.S. agencies to work toward an international understanding on the nature of liability and potential indemnification, and does not support any Commission action on indemnification or the specific Commission proposal.

Lockheed Martin is particularly wary of the proposed requirement for the licensee to have indemnification commitments in place 30 days after licensing, noting that this will be a very difficult obligation for most new licensees to meet, given the inchoate nature of system designs at that early point.

III. CONCLUSION

In the foregoing comments, Lockheed Martin has addressed, in both general and specific terms, many of the proposals and notions the Commission has advanced or raised in its broad re-visitation of the important topic of orbital debris mitigation. Lockheed Martin urges the Commission to take these views into account as it ponders actions – on its own and in conjunction with other key domestic and international players and stakeholders – that promote innovation and manage the risk of orbital debris.

Respectfully submitted,

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